



31.10.2018, AWS Usergroup Dortmund

SAM CLI and Localstack

How to test Serverless?

Daniel Rosowski
Smartsquare GmbH

Software Developer
CTO @ Smartsquare
Cloud Aficionado

 DanielRosowski

 rosowski@smartsquare.de

 Bielefeld

 www.smartsquare.de



Happy Halloween!

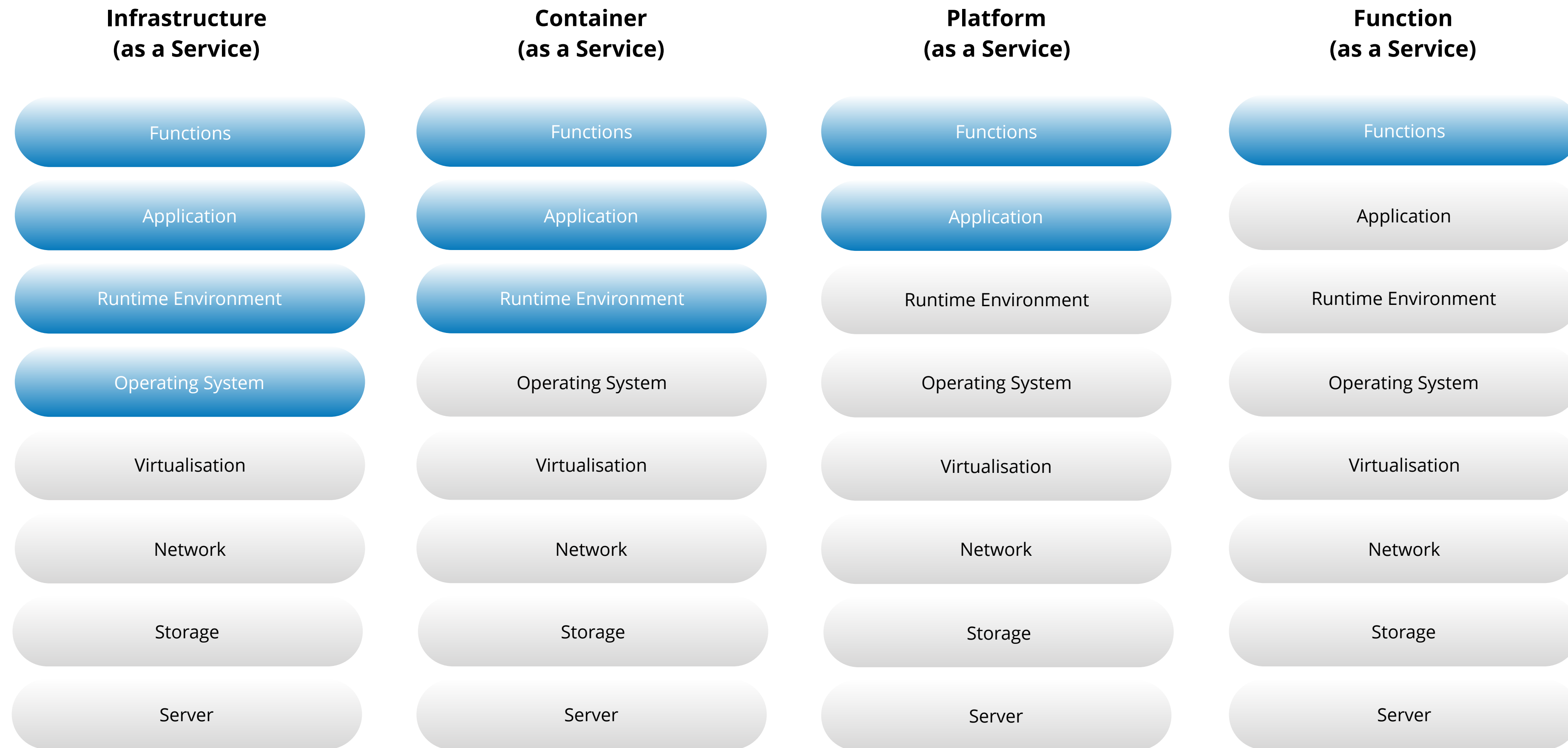


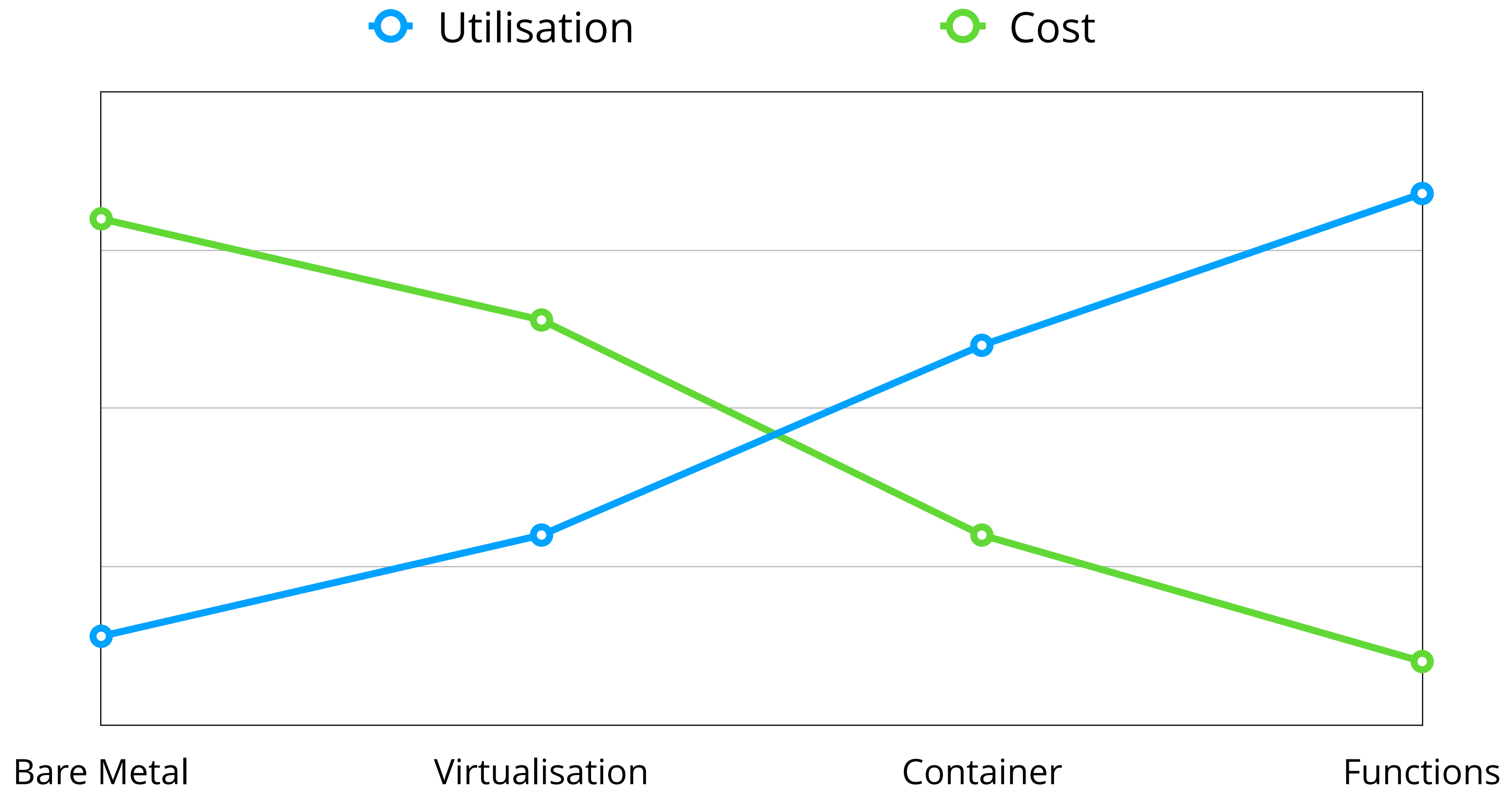
Agenda

- Theorie
 - Serverless
 - AWS SAM
 - AWS SAM CLI
 - Localstack
- Demo!

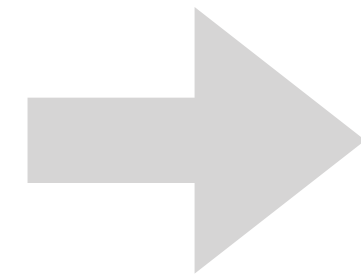
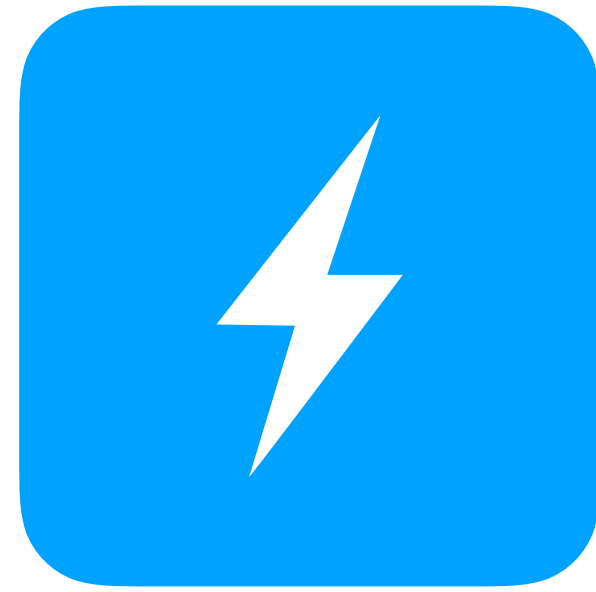


Serverless

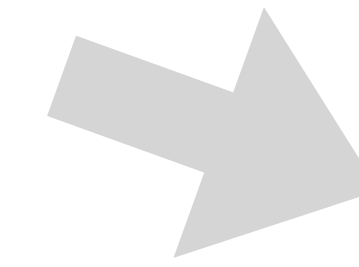
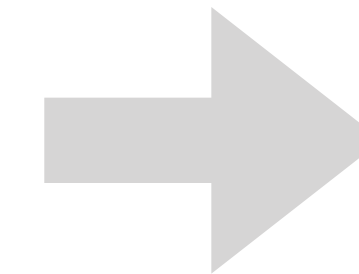
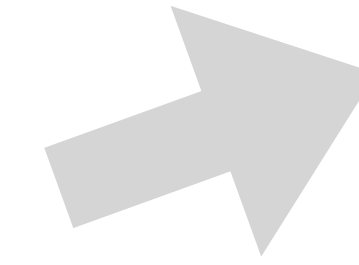




Event



Function



Any Service



Changes in data store
(i.e. DynamoDB)



Request to endpoint



Change in resource
(i.e. S3)



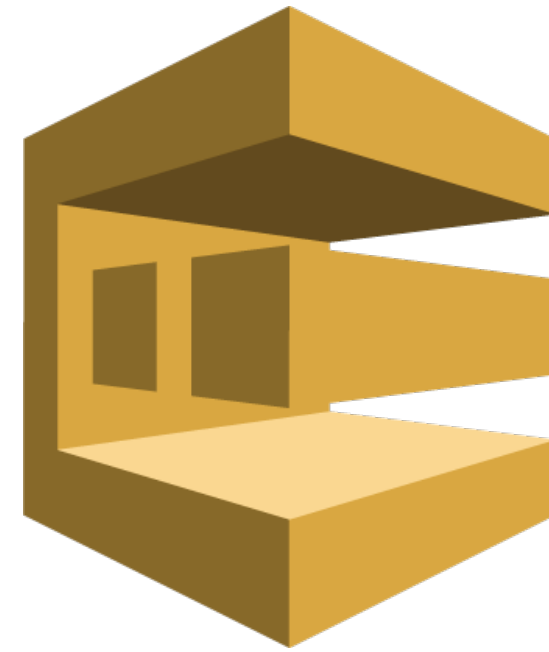
- Node
- Python
- Java
- C#

NodeJS 6.10

```
exports.handler = (event, context, callback) => {  
  // Succeed with the string "Hello World!"  
  callback(null, "Hello World!");  
};
```



Storage



Message Queue



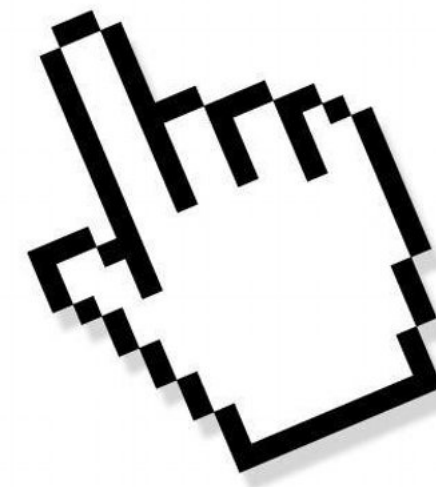
Monitoring



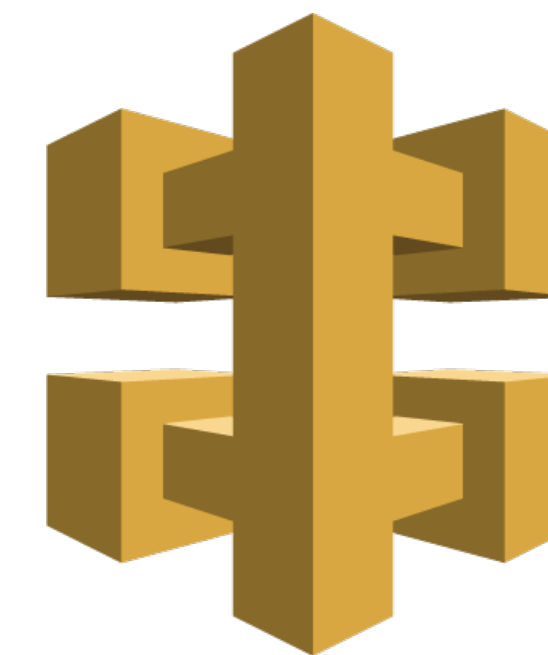
Load Balancer



Database



E-Mail



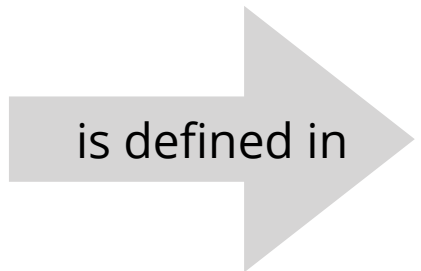
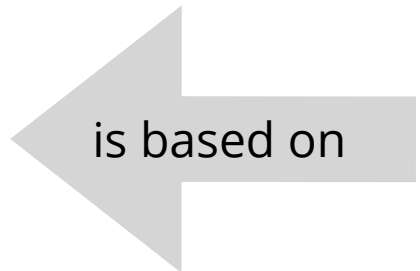
API Gateway

AWS Serverless Application Model

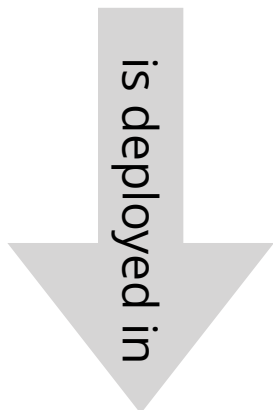
SAM



CloudFormation



CloudFormation
Template



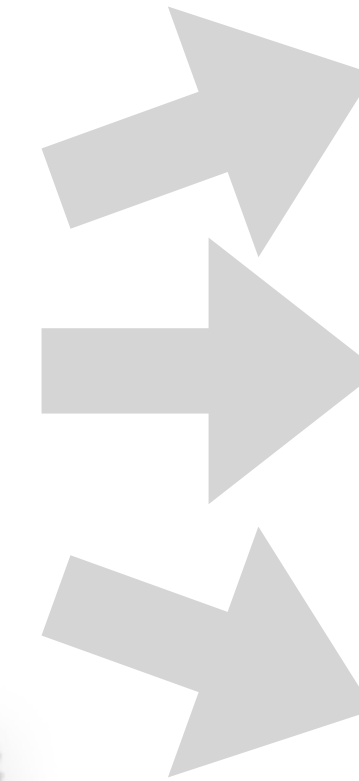
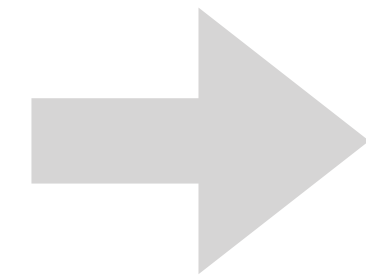
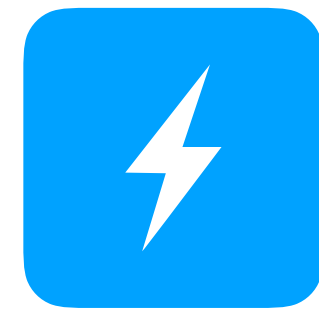
CloudFormation
Stack

sam_template.yml

```
AWSTemplateFormatVersion: '2010-09-09'  
Transform: 'AWS::Serverless-2016-10-31'  
Resources:  
  MyFunction:  
    Type: 'AWS::Serverless::Function'  
    Properties:  
      Handler: index.handler  
      Runtime: nodejs6.10  
      CodeUri: 's3://my-bucket/function.zip'
```

cloudformation_template.json

```
{
  "Resources": {
    "MyServerlessFunctionLogicalID": {
      "Type": "AWS::Lambda::Function",
      "Properties": {
        "Handler": "index.handler",
        "Code": {
          "S3Bucket": „my-bucket“,
          "S3Key": „function.zip“
        },
        "Role": {
          "Fn::GetAtt": ["FunctionNameRole", "Arn"]
        },
        "Runtime": „nodejs6.10“
      }
    },
    "FunctionNameRole": {
      "Type": "AWS::IAM::Role",
      "Properties": {
        "ManagedPolicyArns": ["arn:aws:iam::aws:policy/service-role/AWSLambdaBasicExecutionRole"],
        "AssumeRolePolicyDocument": {
          "Version": "2012-10-17",
          "Statement": [{
            "Action": ["sts:AssumeRole"],
            "Effect": "Allow",
            "Principal": {
              "Service": ["lambda.amazonaws.com"]
            }
          }]
        }
      }
    }
  }
}
```



```

MyFunction:
  Type: 'AWS::Serverless::Function'
  Properties:
    FunctionName: MyFunction
    Handler: index.handler
    Runtime: nodejs6.10
    Timeout: 180
    MemorySize: 128

```

```

Events:
  SomethingUploaded:
    Type: S3
    Properties:
      Bucket: bucket-4711
      Events: s3:ObjectCreated:*

```

```

Events:
  SomethingChanged:
    Type: DynamoDB
    Properties:
      Stream: arn:aws:dynamodb:...
      StartingPosition: LATEST

```

```

MySNSTopic:
  Type: AWS::SNS::Topic
  Properties:
    Subscription:
      - Endpoint: "nobody@nowhere.org"
      Protocol: email

```

```

MyQueue:
  Type: AWS::SQS::Queue
  Properties:
    VisibilityTimeout: 30

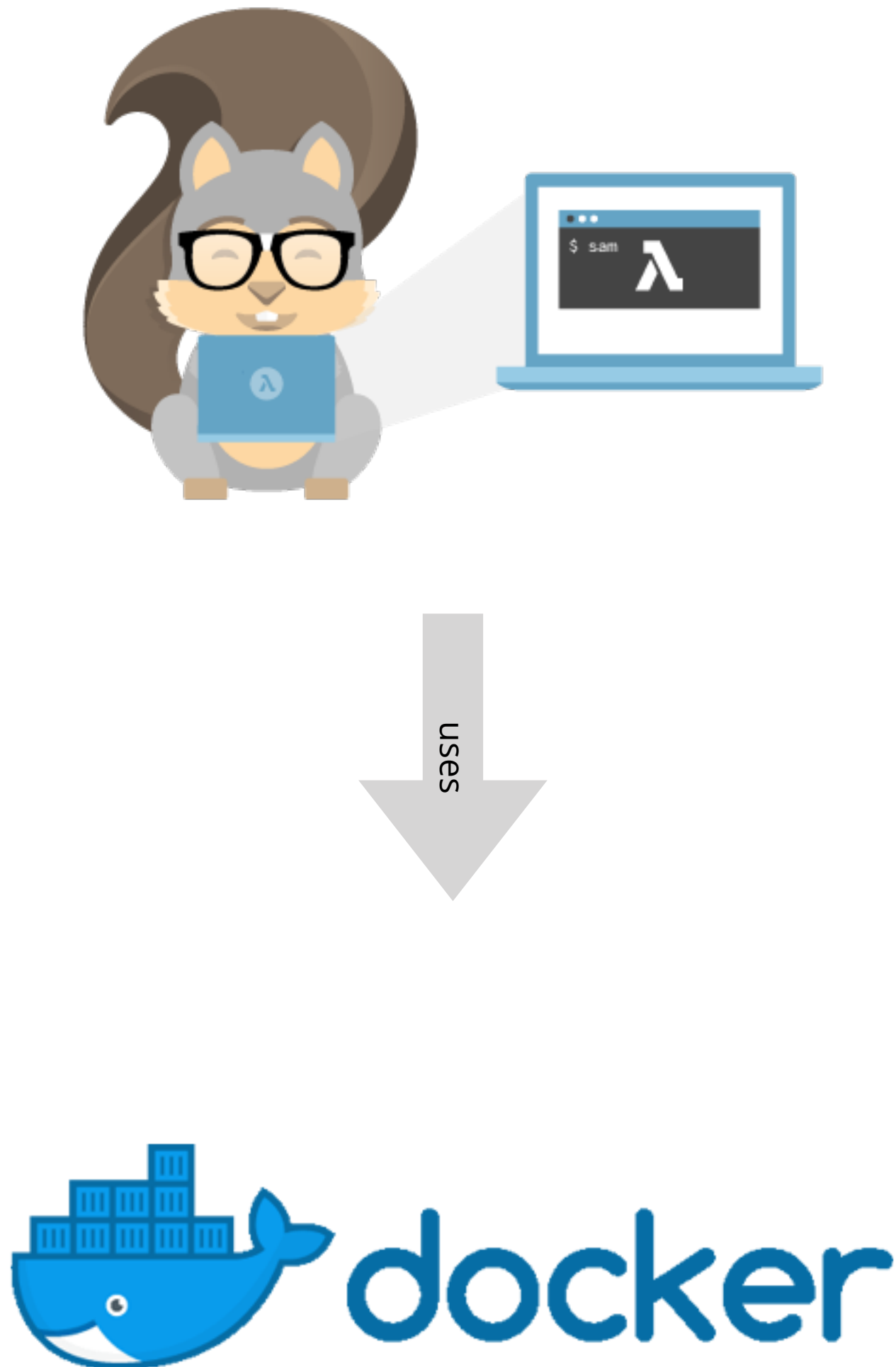
```

SAM CLI

A red, hand-drawn style rectangular stamp with the word "BETA" written inside in a bold, sans-serif font. The stamp is tilted slightly clockwise and overlaps the right side of the "SAM CLI" text.

Main Features

- **Develop and test** your Lambda functions locally with sam local and Docker
- **Invoke functions from known event sources** such as Amazon S3, Amazon DynamoDB, Amazon Kinesis Streams, etc.
- **Start local API Gateway** from a SAM template, and quickly iterate over your functions with hot-reloading
- **Validate** SAM templates
- Get started with **boilerplate Serverless Service** in your chosen Lambda Runtime



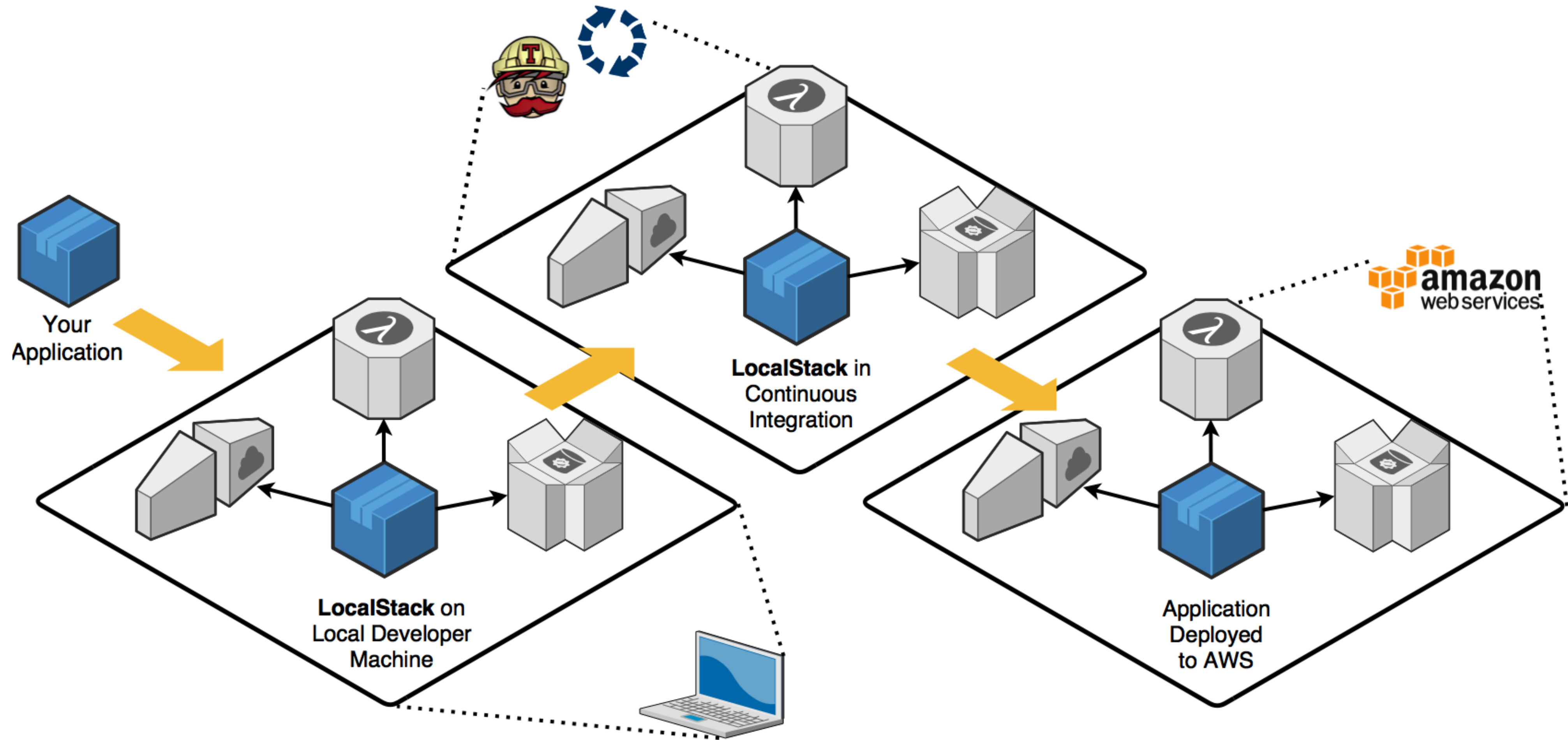
Project Status

- Python Versions support
 - Python 2.7
 - Python 3.6
- Supported AWS Lambda Runtimes
 - nodejs
 - nodejs4.3
 - nodejs6.10
 - nodejs8.10
 - java8
 - python2.7
 - python3.6
 - go1.x
 - dotnetcore1.0
 - dotnetcore2.0
 - dotnetcore2.1
- AWS credential support
- Debugging support
- Inline Swagger support within SAM templates
- Validating SAM templates locally
- Generating boilerplate templates



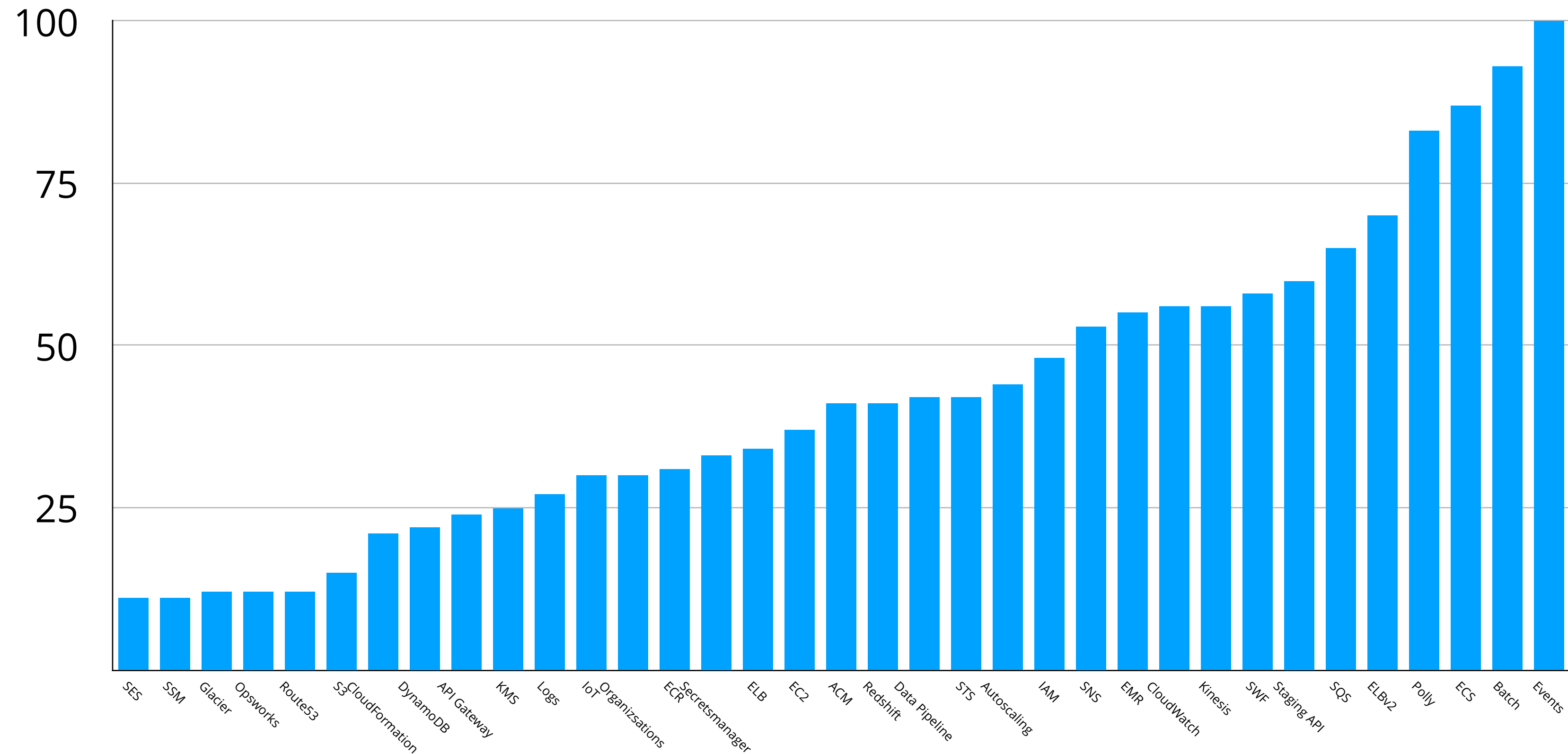
LocalStack

 A fully functional local AWS cloud stack. Develop and test your cloud apps offline!



Source: <https://localstack.cloud>

Implementation Coverage



Source: https://github.com/spulec/moto/blob/master/IMPLEMENTATION_COVERAGE.md

Sample Coverage

sns - 53% implemented

- add_permission
- check_if_phone_number_is_opted_out
- confirm_subscription
- create_platform_application
- create_platform_endpoint
- create_topic
- delete_endpoint
- delete_platform_application
- delete_topic
- get_endpoint_attributes
- get_platform_application_attributes
- get_sms_attributes
- get_subscription_attributes
- get_topic_attributes
- list_endpoints_by_platform_application
- list_phone_numbers_opted_out
- list_platform_applications
- list_subscriptions
- list_subscriptions_by_topic
- list_topics
- opt_in_phone_number
- publish
- remove_permission
- set_endpoint_attributes
- set_platform_application_attributes
- set_sms_attributes
- set_subscription_attributes
- set_topic_attributes
- subscribe
- unsubscribe

sqs - 65% implemented

- add_permission
- change_message_visibility
- change_message_visibility_batch
- create_queue
- delete_message
- delete_message_batch
- delete_queue
- get_queue_attributes
- get_queue_url
- list_dead_letter_source_queues
- list_queue_tags
- list_queues
- purge_queue
- receive_message
- remove_permission
- send_message
- send_message_batch
- set_queue_attributes
- tag_queue
- untag_queue

cloudwatch - 56% implemented

- delete_alarms
- delete_dashboards
- describe_alarm_history
- describe_alarms
- describe_alarms_for_metric
- disable_alarm_actions
- enable_alarm_actions
- get_dashboard
- get_metric_data
- get_metric_statistics
- list_dashboards
- list_metrics
- put_dashboard
- put_metric_alarm
- put_metric_data
- set_alarm_state

Source: https://github.com/spulec/moto/blob/master/IMPLEMENTATION_COVERAGE.md

Dashboard

0.0.0.0:8080/#/infra

Suchen

Overview of Deployed Resources

Settings

Hide disconnected

nodes

Local AWS

Endpoints

Name filter

Refresh

S3 Bucket
wecky-screens

DynamoDB
User

DynamoDB
Website

DynamoDB
WebsiteHashes

Kinesis
__ddb_stream_WebsiteHashes
[hide shards](#)

Selection

Selected Element: wecky-screens

Element Type: s3

Amazon ARN: arn:aws:s3:::wecky-screens

Element Properties

Size: n/a KB

Number of Objects: n/a

Costs

t.b.a.

JUnit Integration

```
...
import cloud.localstack.LocalstackTestRunner;
import cloud.localstack.TestUtils;

@RunWith(LocalstackTestRunner.class)
public class MyCloudAppTest {

    @Test
    public void testLocalS3API() {
        AmazonS3 s3 = TestUtils.getClientS3();
        List<Bucket> buckets = s3.listBuckets();
        ...
    }
}
```

JUnit 4

```
@ExtendWith(LocalstackExtension.class)
public class MyCloudAppTest {

}
```

JUnit 5

JUnit Docker

```
@RunWith(LocalstackDockerTestRunner.class)
@LocalstackDockerProperties(randomizePorts = true,
    services = { "sqs", "kinesis:77077" })
public class MyDockerCloudAppTest {

    @Test
    public void testKinesis() {
        AmazonKinesis kinesis = DockerTestUtils.getClientKinesis();

        ListStreamsResult streams = kinesis.listStreams();
        ...
    }
}
```

JUnit 4

```
@ExtendWith(LocalstackDockerExtension.class)
@LocalstackDockerProperties(randomizePorts = true,
    services = { "sqs", "kinesis:77077" })
public class MyCloudAppTest {

}
```

JUnit 5

Demo

in case of emergency, continue with slides :-)

```
danielrosowski@ApertureLab: ~  
🐿 → ~ sam --help  
Usage: sam [OPTIONS] COMMAND [ARGS]...  
  
AWS Serverless Application Model (SAM) CLI  
  
The AWS Serverless Application Model extends AWS CloudFormation to provide  
a simplified way of defining the Amazon API Gateway APIs, AWS Lambda  
functions, and Amazon DynamoDB tables needed by your serverless  
application. You can find more in-depth guide about the SAM specification  
here: https://github.com/aws-labs/serverless-application-model.  
  
Options:  
  --debug      Turn on debug logging to print debug message generated by SAM  
               CLI.  
  --version    Show the version and exit.  
  --help      Show this message and exit.  
  
Commands:  
  validate  Validate an AWS SAM template.  
  logs      Fetch logs for a function  
  init      Initialize a serverless application with a...  
  deploy    Deploy an AWS SAM application. This is an alias for 'aws  
            cloudformation deploy'.  
  local     Run your Serverless application locally for...  
  package   Package an AWS SAM application. This is an alias for 'aws  
            cloudformation package'.  
🐿 → ~ █
```

```
danielrosowski@ApertureLab: ~/sam-app
🦊 → ~ sam init
[+] Initializing project structure...
[SUCCESS] - Read sam-app/README.md for further instructions on how to proceed
[*] Project initialization is now complete
🦊 → ~ cd sam-app
🦊 → sam-app sam validate
2018-10-24 09:41:23 Found credentials in shared credentials file: ~/.aws/credentials
/Users/danielrosowski/sam-app/template.yaml is a valid SAM Template
🦊 → sam-app
```

```
danielrosowski@ApertureLab: ~/sam-app
👉 → sam-app echo "{}" | sam local invoke "HelloWorldFunction"
2018-10-24 09:45:43 Reading invoke payload from stdin (you can also pass it from file with --event)
2018-10-24 09:45:43 Invoking app.lambdaHandler (nodejs8.10)
2018-10-24 09:45:43 Found credentials in shared credentials file: ~/.aws/credentials

Fetching lambci/lambda:nodejs8.10 Docker container image.....
2018-10-24 09:45:45 Mounting /Users/danielrosowski/sam-app/hello_world as /var/task:ro inside runtime container
START RequestId: 097def2e-2e80-1b1b-e4ad-fa0e86c3874d Version: $LATEST
END RequestId: 097def2e-2e80-1b1b-e4ad-fa0e86c3874d
REPORT RequestId: 097def2e-2e80-1b1b-e4ad-fa0e86c3874d  Duration: 430.31 ms      Billed Duration: 500 ms Memory Size: 128
MB      Max Memory Used: 33 MB

{"statusCode":200,"body":{"\"message\": \"hello world\", \"location\": \"78.94.203.122\"}}
👉 → sam-app
```

```
danielrosowski@ApertureLab: ~/sam-app
👉 → sam-app sam package --template-file template.yaml --s3-bucket sam-cli-demo
Uploading to f07764b9ea80bf5ec911e689edd118a4 958115 / 958115.0 (100.00%)
AWSTemplateFormatVersion: '2010-09-09'
Description: 'sam-app'

Sample SAM Template for sam-app

Globals:
  Function:
    Timeout: 3
Outputs:
  HelloWorldApi:
    Description: API Gateway endpoint URL for Prod stage for Hello World function
    Value:
      Fn::Sub: https://${ServerlessRestApi}.execute-api.${AWS::Region}.amazonaws.com/Prod/hello/
  HelloWorldFunction:
    Description: Hello World Lambda Function ARN
    Value:
      Fn::GetAtt:
        - HelloWorldFunction
        - Arn
  HelloWorldFunctionIamRole:
    Description: Implicit IAM Role created for Hello World function
    Value:
      Fn::GetAtt:
        - HelloWorldFunctionRole
```

```
localstack start
~ localstack start
Starting local dev environment. CTRL-C to quit.
Starting mock API Gateway (http port 4567)...
Starting mock DynamoDB (http port 4569)...
Starting mock SES (http port 4579)...
Starting mock Kinesis (http port 4568)...
Starting mock Redshift (http port 4577)...
Starting mock S3 (http port 4572)...
Starting mock CloudWatch (http port 4582)...
Starting mock CloudFormation (http port 4581)...
Starting mock SSM (http port 4583)...
Starting mock SQS (http port 4576)...
Starting local Elasticsearch (http port 4571)...
Starting mock SNS (http port 4575)...
Starting mock DynamoDB Streams service (http port 4570)...
Starting mock Firehose service (http port 4573)...
Starting mock Route53 (http port 4580)...
Starting mock ES service (http port 4578)...
Starting mock Lambda service (http port 4574)...
2018-10-24T09:55:55:WARNING:infra.pyc: Service "elasticsearch" not yet available, retrying...
Ready.
```

```
danielrosowski@ApertureLab: ~  
→ ~ awslocal dynamodb create-table --table-name Attendees \  
--attribute-definitions AttributeName=email,AttributeType=S AttributeName=name,AttributeType=S \  
--key-schema AttributeName=email,KeyType=HASH AttributeName=name,KeyType=RANGE \  
--provisioned-throughput ReadCapacityUnits=5,WriteCapacityUnits=5  
{  
  "TableDescription": {  
    "AttributeDefinitions": [  
      {  
        "AttributeName": "email",  
        "AttributeType": "S"  
      },  
      {  
        "AttributeName": "name",  
        "AttributeType": "S"  
      }  
    ],  
    "TableName": "Attendees",  
    "KeySchema": [  
      {  
        "AttributeName": "email",  
        "KeyType": "HASH"  
      },  
      {  
        "AttributeName": "name",  
        "KeyType": "RANGE"  
      }  
    ]  
  }  
}
```

 awslocal is a small wrapper that appends `--endpoint localhost` to every aws call


```
danielrosowski@ApertureLab: ~/Documents/awslocal
→ awslocal awslocal dynamodb put-item --table-name Attendees --item file:///item.json
→ awslocal awslocal dynamodb scan --table-name Attendees
{
  "Items": [
    {
      "name": {
        "S": "Daniel Rosowski"
      },
      "email": {
        "S": "rosowski at smartsquare.de"
      }
    }
  ],
  "Count": 1,
  "ScannedCount": 1,
  "ConsumedCapacity": null
}
→ awslocal []
```

```
danielrosowski@ApertureLab: ~/Documents/awslocal
👉 → awslocal awslocal s3 mb s3://wecky-screens
make_bucket: wecky-screens
👉 → awslocal awslocal s3 cp TIME-4711.png s3://wecky-screens
upload: ./TIME-4711.png to s3://wecky-screens/TIME-4711.png
👉 → awslocal awslocal s3 cp TIME-4711.png s3://wecky-screens
upload: ./TIME-4711.png to s3://wecky-screens/TIME-4711.png
👉 → awslocal █
```

***Thank you very
much!*** 🙌

🐦 DanielRosowski
✉ rosowski@smartsquare.de

🌐 www.smartsquare.de

 **Smartsquare GmbH**



Links

- <https://github.com/aws-labs/serverless-application-model>
- <https://github.com/aws-labs/aws-sam-cli>
- <https://github.com/localstack/localstack>
- Tutorials
 - <https://docs.aws.amazon.com/serverless-application-model/latest/developerguide/serverless-test-and-debug.html>
 - <https://aws.amazon.com/de/blogs/aws/aws-serverless-application-model-sam-command-line-interface-build-test-and-debug-serverless-apps-locally/>
- Sample Projects
 - <https://github.com/smartsquare/wecky-web>
 - <https://github.com/smartsquare/wecky-crawl>
 - <https://github.com/smartsquare/wecky-capture/>
 - <https://github.com/smartsquare/wecky-notify>